

Inference

Mayar

1/22/2022

Simulation

```
library(ggplot2)
library(knitr)

no_simulation <- 1000 # number of simulations
lambda <- 0.2
n <- 40 # sample size

simulated_data <- matrix(rexp(n= no_simulation*n,rate=lambda), no_simulation, n)
sample_mean <- rowMeans(simulated_data)
```

Sample Mean VS Theoretical Mean

```
actual_mean <- mean(sample_mean)
theoretical_mean <- 1/ lambda

result1 <-data.frame("Mean"=c(actual_mean,theoretical_mean),
                     row.names = c("Mean from the samples ", "Theoretical mean"))

result1
```

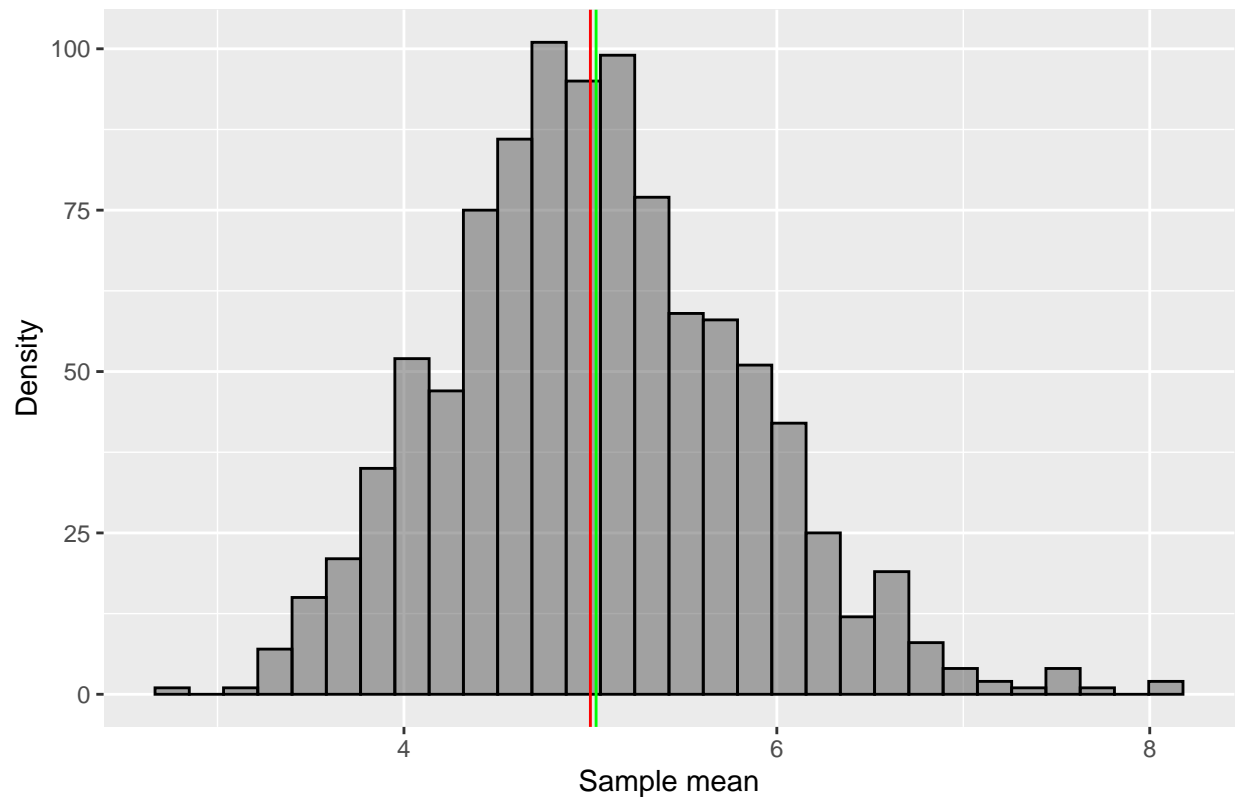
```
##               Mean
## Mean from the samples  5.030484
## Theoretical mean      5.000000
```

```
sampleMean_data <- as.data.frame (sample_mean)

ggplot(sampleMean_data, aes(sample_mean))+geom_histogram(alpha=.5, position="identity", col="black")+g

## 'stat_bin()' using 'bins = 30'. Pick better value with 'binwidth'.
```

Histogram of the sample means



Sample Variance VS Theoretical Variance

```
actual_variance <- var(sample_mean)

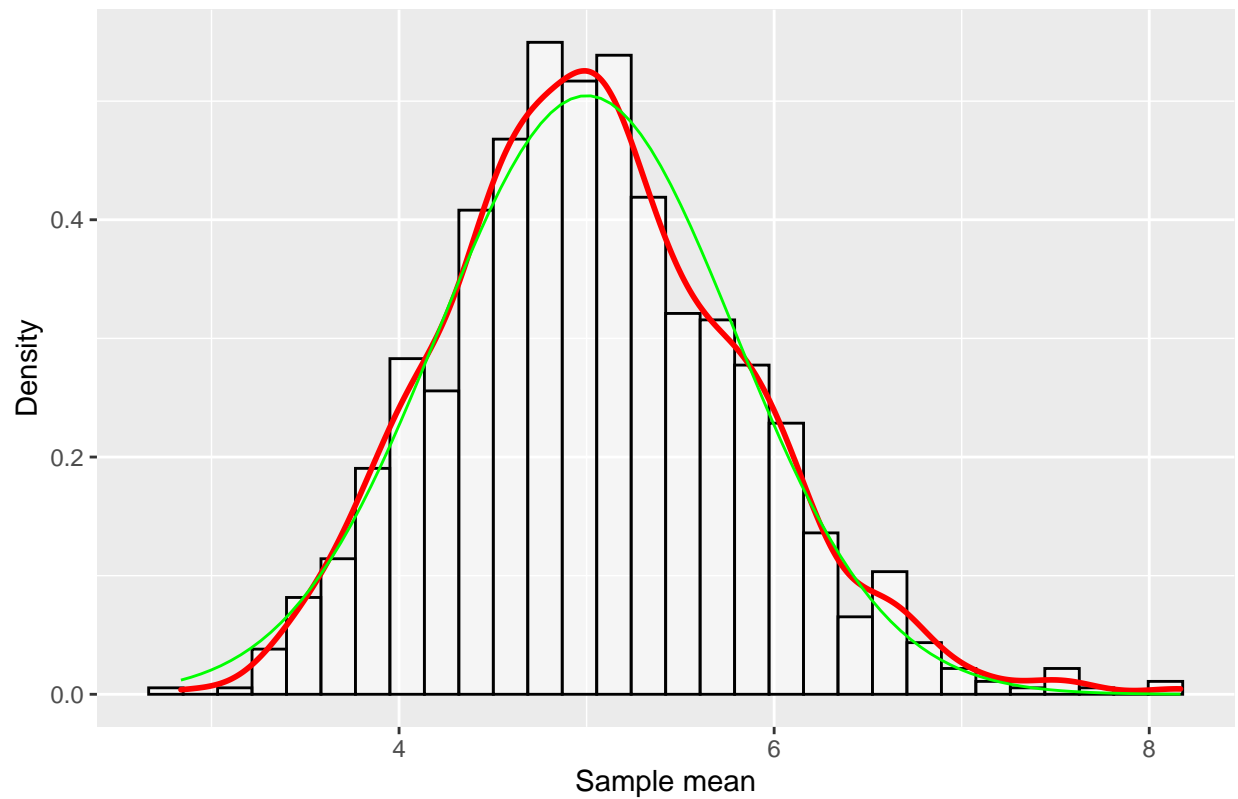
theoretical_variance <- (1/ lambda)^2 /n

result2 <-data.frame("Variance"=c(actual_variance, theoretical_variance),
                      row.names = c("Variance from the sample ", "Theoretical variance"))
```

```
ggplot(sampleMean_data, aes(sample_mean))+
  geom_histogram(aes(y=..density..), alpha=.5, position="identity", fill="white", col="black")+
  geom_density(colour="red", size=1)+
  stat_function(fun = dnorm, colour = "green", args = list(mean = theoretical_mean, sd = sqrt(theo
  ggtitle ("Histogram of sample means with the fitting normal curve ")
  xlab("Sample mean")+
  ylab("Density")
```

```
## 'stat_bin()' using 'bins = 30'. Pick better value with 'binwidth'.
```

Histogram of sample means with the fitting normal curve



```
qqnorm(sample_mean, main = "Normal probability plot")  
qqline(sample_mean, col = "3")
```

Normal probability plot

